Bharati Vidyapeeth's Institute of Technology

Navi Mumbai

Certificate

This is to certify that, Mr/ Ms. …….

Roll No. ……. of fifth Semester of Diploma in Civil engineering of Bharati Vidyapeeth Institute of Technology Navi Mumbai (Inst.code:0027) has satisfactorily completed the term work in the subject Water Resources Engineering (22501) for the academic year 20…. to 20…. as prescribed in the MSBTE curriculum.

Place: ……... **Enrollment No. : ……**

Date:……. **Exam. Seat No. : …….**

Sign:

Name:

Subject Teacher **Head of the Department** **Principal**

Seal of Institution

List of experiments and progressive assessment for term work (TW) D-3

Academic Year: **Name of Faculty:**

Course code: 22501 **Subject Code: WRE (22501)**

Name of candidate: **Enroll no.** **Roll no.**

Semester: FIFTH **Marks: Max : 25 Min :10**

Sr. No.	Title	Date of performance	Date of submission	Marks	Sign of teacher
1	Calculate average rainfall for the given area using arithmetic mean method.				
2	Calculate average rainfall for the given area using Isohyetal, Theissen polygon method.				
3	Delineation of the contributory area for the given outlet from the given topo sheet.				
4	Compute the yield of the catchment area demarcated in Sr.No.2				
5	Estimate crop water requirement for the given data.				
6	Estimate capacity of the canal for the given data.				
7	Calculate reservoir capacity from the given data.				
8	Calculate control levels for the given data for the given reservoir.				
9	Draw a labeled sketch of the given Masonry/ Earthen dam section.				
10	Draw the theoretical and practical profile of the given gravity dam section.				
11	Prepare a presentation on the technical details of any one micro or minor irrigation scheme.				

12	**Prepare a maintenance report for any major/minor irrigation project site in the vicinity of your area, based on field visit.**				
13	**Prepare summary of the technical details of any existing water resource project in the vicinity of your area.**				
14	**Draw a labeled sketch of the given diversion head works and CD works.**				
15	**Design a canal section for the given conditions with estimation of the quantity of material required for lining of the given canal**				
Total marks out of 100					
Marks out of 25					

EXPERIMENT: -1

Aim: Calculate average rainfall for the given area using arithmetic mean method.

Theory: The no. of rain-gauge stations depends upon the area and distribution of rainfall. If a basin or catchment area contains more than one rain-gauge station, the computation of average rainfall may be done by the arithmetic mean method.

When the area of the basin is less than 500 km2 this method implies summing up of all the rainfall values from all the rain gauging stations and then dividing it by the number of stations in that basin. The simplest of all is the Arithmetic Mean Method, which taken an average of all the rainfall depth.

The value obtained by this method is average not accurate.

Procedure:

1. Record the rainfall as P1,P2,P3……Pn at respective no. of stations 1,2,3…….n.
2. n is the no. of rain gauges
3. Now to find the average rainfallapply the Average mean formula.

Observations:

The Rainfall record at a given station is as bellow:

Station	**Record**

Calculations:

Pavg = $\frac{P1+P2+P3+\cdots\ldots\ldots\ldots pn}{n}$

Result:

Average rainfall of the given area by arithmetic mean method is ……..

Questions:

1. What is Riangauge.
2. Explain use of Areathmatic mean method.

……

……

……

……

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT: -2

Aim: - Calculate average rainfall for the given area using Isohyetal, Thiessen's polygon method.

Apparatus required:: - Drawing Sheet, Digital Planimeter,Drawing instruments

Theory: Isohyetal and Theissen polygon method are another two methods to calculate average rainfall.

Isohytel Method

Isohyetal is a imaginary line joiningthe points of equal or same rainfall records. It is most accurate method to calculate average rainfall because division of area is according to actual rainfall records.

Procedure

1 Mark the area on toposheet.

2 Mark the position of raingauge stations in the area.

3 Enter rainfall records at each raingauge station.

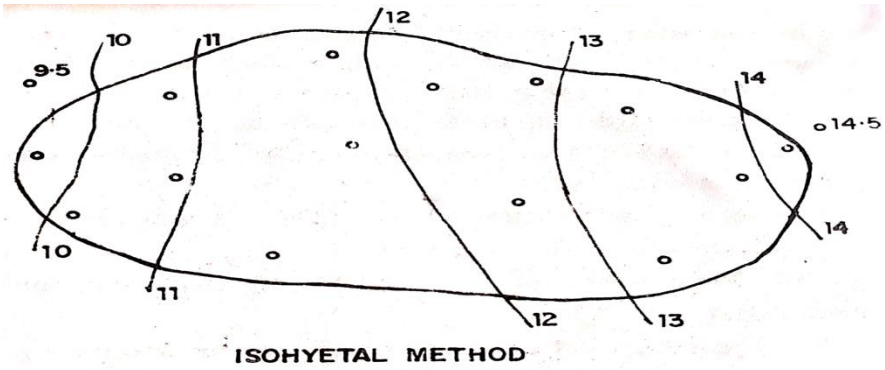
4 Interpolates the Isohyte according to these rainfall records just as contour.

5 Measure the area acquired between the successive Isohytel by Planimeter.

6 Average rainfall Pavg=

$$\frac{\left(\left(A1 \times \frac{p1+P2}{2}\right)+\left(A2 \times \frac{P2+p3}{2}\right)+\cdots\ldots\right)}{A1+A2+\cdots\ldots}$$

Where, A1 and A2 are the area in km^2 between the isohyetal lines.



ISOHYETAL METHOD

Observations:

Station	**Record**

Calculations:

Pavg=

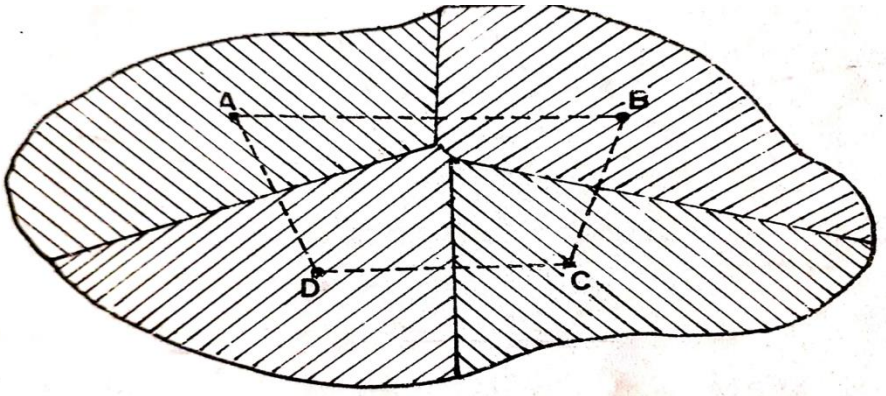
2 Thiessen's Polygon Method.

This is another method to calculate average rainfall. This method is more accurate than the arithmetic mean method but not the most accurate because division of area is done done graphically on site.

Procedure:

1. Plot the location of rain gauges on the base map with a pencil.
2. Connect adjacent points with dashed lines using a straight edge and pencil.
3. Construct perpendicular bisectors across the dashed boundary lines and extend them until they meet each other.
4. Due to this each rain gauge station is enclosed in one area only. Measure the areas as A1,A2,A3,……..An.
5. Let the Rainfall record at rain gauges be P1,P2,P3……Pn.
6. Average rainfall P calculated as

$$P = \frac{A_1 P_1 + A_2 P_2 + ------ A_n P_n}{A_1 + A_2 + A_3 -- A_n}$$



THIESSEN POLYGON METHOD

Observations:

Station	**Record**

Calculations: By Thiessens polygon method

Result: -1) Average rainfall the given area by Isohyetal method is ……..

2) Average rainfall the given area by Theissen's polygon method is ……..

Questions:

1) What is Isohyetal line?

2) Which is most accurate method and why?

Answers:

……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT: -3

Aim: - Delineation of the contributory area for the given outlet from the given topo sheet..

Apparatus required: - Toposheet, Digital Planimeter

Theory:

Catchment area:

It is the area the area on upstream side from the location of dam from which all the rainwater is collected at the dam location due to the ground slope. This area is mark on the top sheet by joining the highest ridges on the topography. The area is measured in km^2 or hect.

Types of (C.A.)Catchment area

1) **Fan Shape**

Advantage of fan shape Catchment area.

- The area is large hence average rainfall over the total area is more and hence water collected is also more.
- There will be rainfall in some part in the catchment due to which water will be collected at dam location.

Disadvantage of fan shape Catchment area.

- The rainwater has to travel a long distance till it reaches the dam location due to this evaporation and percolation losses will increase reducing the net amount of runoff.
- The entire area may not have rainfall of same intensity at same time, hence net runoff may reduce.

2)Fern Shape

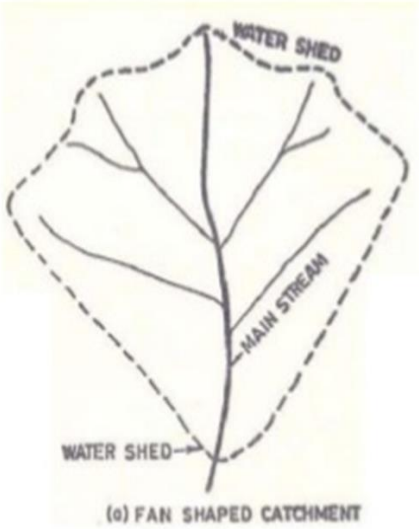
Advantage of fern shape catchment area.

- The rainwater does not have to travel a long distance till it reaches the dam location due to this evaporation and percolation losses will be less and the net amount of runoff will increase..
- The entire area may have rainfall of same intensity at same time, hence net runoff will increase.

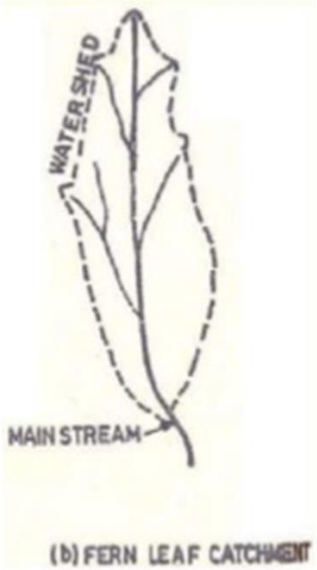
Disadvantages of fern shape catchment area.

- The area is small hence average rainfall over the total area is less and hence water collected is also less.
- As the area is small the entire catchment may remain dry sometimes, hence runoff is less

A. Fan shaped catchment B. Fern Leaf Catchment



(a) FAN SHAPED CATCHMENT



(b) FERN LEAF CATCHMENT

Result: -

Questions:

1) What is catchment area?

2) Explain type of catchment area.

Answers:

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT 4

Aim: Compute the yield of the catchment area demarcated in Sr.No.
P avg=……..cm from pract no 2

Theory:

Yield

It is the total volume of water or long term runoff collected at dam location in the period of one year.It can be calculated from the catchment area and runoff. Thus

Yield = Catchment Area × Run off

Dependable Yield

It is the value of yield which will be available every year throughout the life of dam.

Dependable yield= Catchment Area × dependable runoff

Dependable Yield from past period

Procedure

1. Prepare a list of rainfall values for last successive 35 years or more . Foe 2019 the records will be from 1983 to 2018
2. Arrange the rainfall in dcending order.
3. Give serial number to the new list of rainfall in decending order as 1,2,3,4,5….,35.
4. The serial number at which the dependable rainfall is availablr is calculated from the given equation.

$$\text{Sr.No.} = (P\%/100)\times N$$

Where, p= dependable percentage
N= no. of years for which dta is available

So , rainfall at this serial no. is the dependable rainfall.

Rule:

If the serial no.is in fraction average of the rainfall value of two successive number is the dependable rainfall.

Calculation:

The rainfall and catchment area is taken frompractical no 2,Theissons Polygaon method.

P avg=……..cm from pract no 2

Result:

1 We compute the yield of catchment area is ……

Questions:

1. Define yield.

2. Explain dependable yield.

……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT 5

Aim : Estimate crop water requirement for the given data.

Theory:

Base Period:

It is the period measured in number of days from first watering to the field to the last watering to the field before harvesting. It is the actual number of days for which water is supplied to crops.

Duty

Duty is the area of land that can be irrigated with a unit volume of water supplied across the base period.It is denoted by D. Its unit is measured in units of ha/cu

The water requirement for various crops is different. So the duty varies from crop to crop.

Delta

Delta is the depth of water required for complete maturity of crop in base period. Its unit is cm or m.

For example,

If Kharif crop requires 1 cm daily depth of water then the delta for that crop with a base period of 123 days is 1×123=123 cm.

Relationship between Duty,Delta and Base period:

'D'hectors of land is irrigated by water at the rate of m^3/s continuously in the base period total depth supplied in delta cm of water.

1) Volume of water from duty side
   = Bdays × 1 m^3.s
   = 86400 B m^3
2) Volume of water from delta side
   = D ha × Δ
   = D×10^4 m^2 × Δ /10^2 m
   =100 D Δ m^3
   Since volume of water is same equating
   duty = delta
   86400 B = 100 D Δ

Δ = 864B/D

Where,

B base period is in days.

D is duty is in ha.

Δ is depth of water in cm.

NOTE: When Δ is in m then 8.64

And if Δ is in cm then 864.

Given Data:

Calculation:

Result:

Questions:

1. Define Duty, Delta
2. Define base period

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT 6

Aim: Estimate capacity of the canal for the given data

Given data:

Sr.No	Seasons	Crop	Base Period(B)	Area(ha)	Delta
1	Kharif	Rice	123	4100	120.00
2		Cotton	123	4120	50.00
3		Maize	123	4122	25.00
4	Rabi	Wheat	122	4000	40.00
5		Barley	122	4111	30.00
6		Gram	122	4001	35.00
7	Hot weather	Garden Fruits	120	4002	60.00
8		Vegetable's	120	4003	45.00
9		Fodder	120	4004	22.50
10	Eight Month	Tobacco	245	4005	75.00
11		Ground Nut	245	4006	80.00
12	Yearly	Sugarcane	365	4005	120.00
13		Vegetable's	365	4006	45.00
14		Orchids	365	4993	60.00

Consider traqnsit losses 12%,time factor=0.7,capacity factor o.8.

Theory

Outlet Factor

It is defined as the duty at the outlet.

Time factor:

Time factor of a canal is the ratio of the number of days the canal has actually run to the number of days of irrigation period.

For example, if the number of days of irrigation period is 12 , and the canal has actually run for 5 days , the time factor will be 5/12.

(Note ; A day has a period of 24 hrs i.e. it include night also.)

Capacity Factor:

It is the ratio of mean or average supply required for crop period to the actul design discharge

Calculation:

Sr.No	Seasons	Crop	Base Period(B)	Area(ha)	Delta	Delta /100	Duty 8.64 ×B/Δ	(Q) =Area/duty
1	Kharif	Rice	123	4100	120.00			
2		Cotton	123	4120	50.00			
3		Maize	123	4122	25.00			
4	Rabi	Wheat	122	4000	40.00			
5		Barley	122	4111	30.00			
6		Gram	122	4001	35.00			
7	Hot weather	Garden Fruits	120	4002	60.00			
8		Vegetable’s	120	4003	45.00			
9		Fodder	120	4004	22.50			
10	Eight Month	Tobacco	245	4005	75.00			
11		Ground Nut	245	4006	80.00			
12	Yearly	Sugarcane	365	4005	120.00			
13		Vegetable’s	365	4006	45.00			
14		Orchids	365	4993	60.00			

Result: Capacity of canal obtained is

Questions:

1. What is capacity of canal?
2. Why we have to find capacity of canal?

……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT 7

Aim: Calculate reservoir capacity from the given data..

Givan data:

Sr.No.	Name of crops	Base period in days (B)	Duty(ha/ cu)	Area (ha)
1	Wheat	120	1800	5400
2	Sugarcane	360	800	6400
3	Cotton	200	1400	3500
4	Vegitable	120	700	1400
5	Rice	120	900	3100

Consider canal losses 20% and reservoir losses are 12%.

Theory:

The maximum quantity of water which a reservoir can store is termed as storage capacity of reservoir.

Reservoirs are usually constructed to serve multiple purposes, such as irrigation, municipal and industrial water supply, hydropower generation, and flood control Water used for multiple purposes including irrigation, energy and drinking-potable and industrial water, etc., increasing demands for water by industrial and urban users require the water resources to be regulated by reservoir. The cost of reservoir are generally the most expensive component of the total project cost. In addition, the capacity of members outside the reservoir generally varies depending on size of the reservoir. The size of a reservoir is determined by calculating the reservoir capacity.

Calculation:

Sr.No.	Name of crops	Δ =864×(B/D)(m)	Area(h)	Volume required= Δ × Area
1	Wheat			
2	Sugarcane			
3	Cotton			
4	Vegitable			
5	Rice			

Result: Reservoir capacity from the given data is

Questions:

1. What are losses in reservoir.?

2. Why we calculate reservoir capacity?

……
……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT -8

Aim : Calculate control levels for the given data for the given reservoir..

Given data:
Catchment area= 5km^2,
Life of dam= 60yrs.
Rate of silting=200 m^3/yr/ km^2,
Total crop water requirement(CWR)= 145 ha.m,
Tank losses= 15% of CWR
Carry over=10% of CWR,
Flood lift= !.5 m,
Free board=2 m
Reduce levels & corresponding storages

R.L.	33	34	35	44	45	46
Storage(ha.m)	4	4.9	9.8	170.4	237.5	277.5

Theory:

- Top of bund level(TBL)

This is the RL of top of dam . The length of the dam is measured at this level.

- High Flood Level(HFL)

This is RL up to which water can rise, whenever flood occurs. This is decided by highest flood occurs in future.

- Full Tank Level(FTL)

This is the RL upto which water will be stored in the reservoir. The top of spillway is kept at this RL

- Dead Storage Level (DSL)

This is the RL at which outlet will be situated. The storage bellow this level is the accumulated silt and thus called as dead storage.

- Dead Storage

The storage bellow outlet sluice is the accumulated silt and thus called as dead storage.

- Live storage

The storage between lowest water level and full tank level is the live storage. It is useful storage decided as per irrigation requirements and losses.

- Gross storage

It is storage at full tank level of dam. Thus gross storage is total of dead and live storage.

- Flood absorption capacity

The capacity between highest flood level(HFL) and tank level(FTL) is called the flood absorption capacity(FAL)

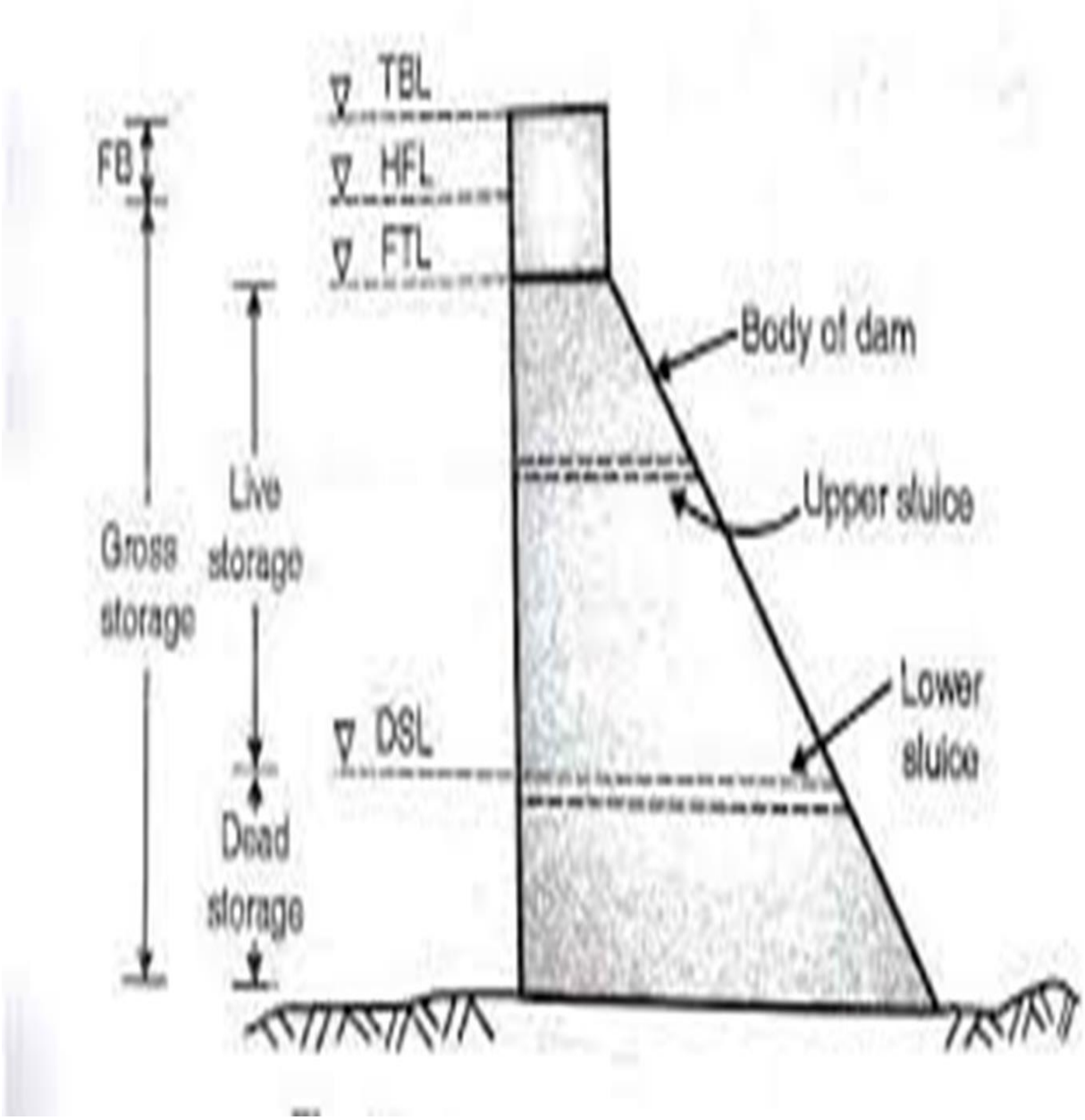
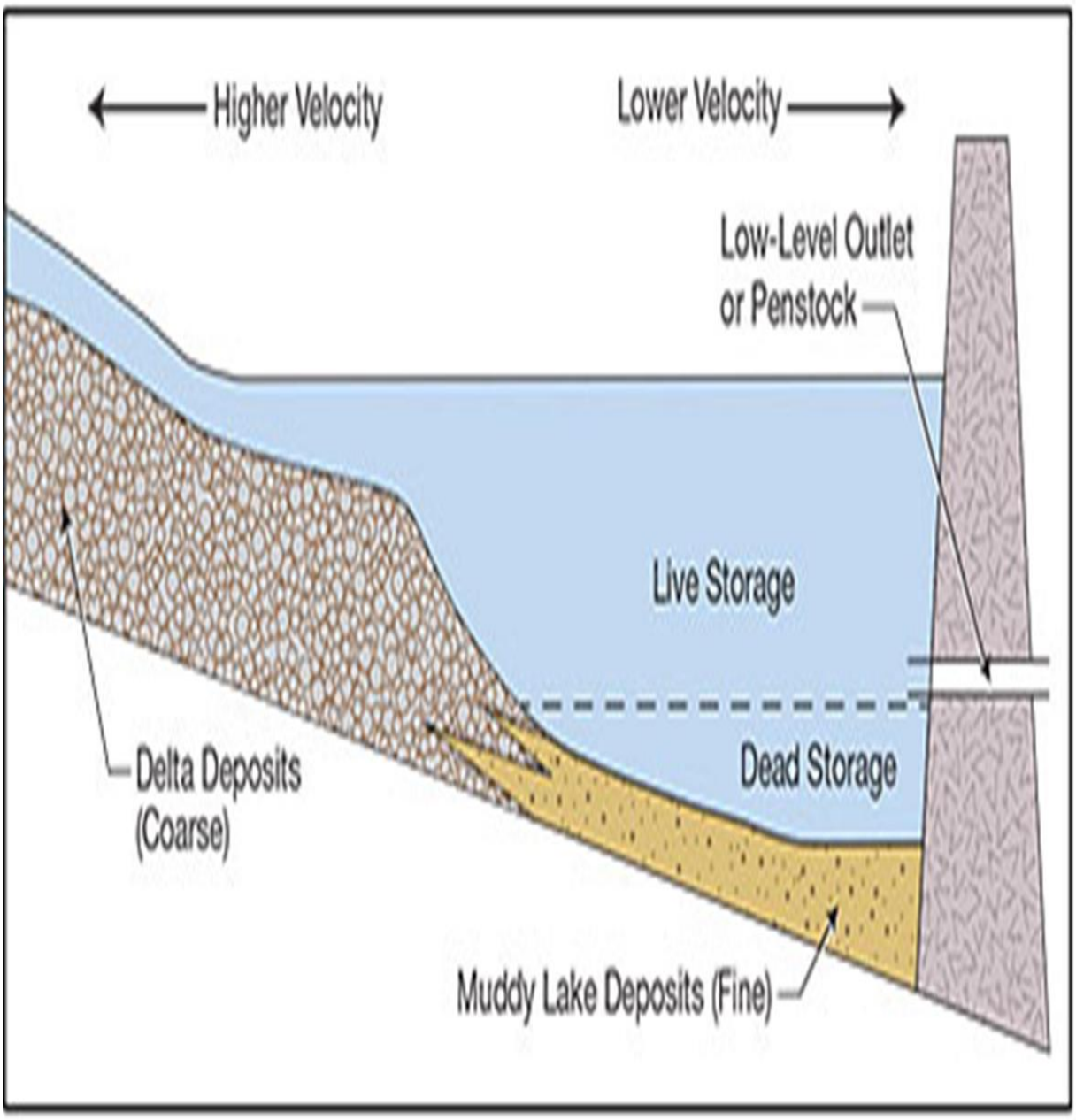


Figure 1 — Typical Reservoir Sediment Profile*



1701HRWdon_201

Typically, sedimentation in the reservoir behind a dam takes the form of progressively finer materials being deposited as the flows approach the dam.

*Adapted from Morris, G.L. and J. Fan, *Reservoir Sedimentation Manual*, McGraw-Hill, New York, 1998.

Calculation:

Result: R.L. of control levels for the given data for the given reservoir are

QUESTIONS:

1) Define Reservoir

2)What are the classification of reservoir?

……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT -9

Aim : Draw a labeled sketch of the given Masonry/ Earthen dam section.

Diagram:

Questions:

1. What is Difference between earthen dam and Gravity dam?

2, Which component carry load in Earthen dam?

……

……

……

……

……

……

……

……

……

……

……

……

……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT 10

Aim: Draw the theoretical and practical profile of the given gravity dam section.

Theory:

Theoretical or Elementary profile :

It is an imaginary section of solid gravity dam having shape of right angled triangle with its base at ground level and apex at HFL.

Theoretical profile is obtained by considering only important forces i.e.,water thrust, self weight, of dam and uplift.

In this profile, water force is vertical and base width can be obtained to fulfill the stability condition

1. No Tension 2No sliding

Practical profile

The Theoretical profile is not possible in practice due to following needs:

1 Providing top width for constructing a road at top of dam.

2 Providing free board so that water may not spill over the body of dam.

But due to these changes, the resultant will shift towards the heel and tension will develop at toe on case the reservoir is empty. In order to avoid this, masonry must be added to upstream side.

Diagram:

Questions:

1. What is the difference between practical profile and Elementary profile?
2. Why free board is provided in practical profile?

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT 11

Aim: Prepare a presentation on the technical details of any one micro or minor irrigation scheme.

Questions:

1) What are types of irrigation?

……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT 12

Aim: Prepare a maintenance report for any major/minor irrigation project site in the vicinity of your area, based on field visit.

Questions:

1)State difference between major and minor irrigation project.

……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT 13

Aim: Prepare summary of the technical details of any existing water resource project in the vicinity of your area.

Questions.

1. State main purpose of water resource project .

.

……
……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

EXPERIMENT NO: - 14

Aim: Draw a labeled sketch of the given diversion head works and CD works.

Questions:

1) What are the parts of CD work and its functions in short?

……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	

…

EXPERIMENT NO: - 15

Aim: Design a canal section for the given conditions with estimation of the quantity of material required for lining of the given canal

Givan Data: -
Side slope= 1:15
Bed Slope =1:!500
Manning's (n)=0.015
Design Discharge Q= 27m^3/s

Solution:

Result: - We concluded that the quantity for designing canal section for the given condition with estimation of

Questions:

1) Define time factor?
2) What are types of canal depending upon soil?

……
……
……
……
……
……
……
……
……
……
……
……
……

Marks obtained			Dated sign of teacher
Process related(15)	Product related(10)	Total (25)	